plant is traced to a difference in physiological stability of their respective protoplasms. In animals the stable molecules which form nervous tissue accumulate in spite of the high metabolic rate, while in plants the degree of physiological stability is low, and the high metabolic rate of the apical point may mobilize the whole substratum. It is only in regions of lower rate that the accumulations of visible structure can occur. In this contrast we see one of the fundamental differences between the two classes of organisms.

The reader is favorably impressed by the thoughtful style and illuminating manner in which the philosophical discussion proceeds. The dynamic conception of individuality presented in this work seems so reasonable, and the marshalled evidence is so clear and convincing, that it is bound to exert a profound influence on biological thought and theory. The author modestly states that this conception is "manifestly far from being a complete solution of the problem of organic individuality." It is an excellent working hypothesis, however, suggests many lines of experimental approach toward a final solution, and offers an attractive substitute for the unsatisfactory vitalistic conceptions which have held until now so prominent a place in our philosophy of organic life.—CHARLES A. SHULL.

NOTES FOR STUDENTS

Linkage and crossing-over in oats.—SURFACE[2] is continuing in *Genetics* a series of studies in oat breeding of which two former papers have appeared in the Annual Report of the Maine Agricultural Experiment Station. It will be very gratifying indeed if this new journal makes so strong an appeal to geneticists that work of high grade will no longer be buried with such ephemeral literature as that which makes up the bulk of nearly every station report.

In crosses between strains of wild and cultivated oats (*Avena fatua* and *A. sativa*), SURFACE has studied particularly the inheritance of qualitative characters in the flowering glumes. The base of the fertile floret in the wild oat is characterized by a broad callus associated with ease of abscission from the spikelet, whereas the lack of the callus in the cultivated oat is associated with persistence of the floret. First generation hybrids present the callus in an intermediate condition, and in subsequent generations typical Mendelian segregation takes place. There are, therefore, three types of bases, called, for short, "cultivated," "intermediate," and "wild." Perfectly correlated with the "cultivated" base are the almost complete absence of awns on the lower flowering glume, their complete absence from the upper flowering glume, the absence of pubescence from the rhachilla, the slight pubescence at the base of the first floret, and its complete absence at the base of the second floret. Conversely, the "wild" base is perfectly correlated with the presence of well de-

[2] SURFACE, FRANK M., Studies on oat breeding. III. On the inheritance of certain glume characters in the cross *Avena fatua*×*A. sativa* var. *Kherson*. Genetics 1:252–286. 1916.

veloped awns on both flowering glumes, a densely pubescent rhachilla, and dense pubescence at the base of both fertile florets. The "intermediate" base, as would be expected, is associated with an intermediate development of the other characters. Thus, in some spikelets the first floret has a medium sized awn, but the second has none; likewise, the first floret has pubescence at the base, but the second is glabrous. It is on the basis of differences between the first and second florets that SURFACE is able to correlate 7 putatively distinct characters with the "cultivated" type of base, but those whose view of Mendelian inheritance is less formal than the author's will wish very clear evidence before admitting them as distinct. SURFACE himself has suggested, following NILSSON-EHLE, that characters may be genetically present in an individual, but not manifest because of environmental conditions. In some strains of oats, for example, awns are potentially present, but develop only under certain external conditions. What is true of a population, acted upon by varying environmental factors, may equally well be true of homologous parts of a single individual, conditioned in development by their position on that individual.

Turning to a concrete case, the spikelet of *Avena* is composed of 2, or at most 3, fertile florets, presenting a gradation from the first, which is large and in every way the most highly developed, to the third, which is ordinarily a sterile or even vestigial structure. In a reduction series composed of so few members, and with so steep a gradient, we have ideal conditions for a variable character to be manifest in the first member and latent in the second. At any rate the reviewer would look for a physiological rather than a genetical explanation for the situation as regards awns and pubescence in the spikelet of *Avena*. If the first flowering glume is awned, it is a fair assumption that the second is potentially the same, even though its position be such that manifestation of the character is a physiological impossibility. Perhaps an underlying basis for the whole group of correlations might be found in the diminution of the vascular supply between the base and apex of the spikelet.

In addition to the characters showing perfect correlation, SURFACE discovered two pairs of characters showing partial linkage. The factor for pubescence on the back of the first flowering glume showed linkage with the factor for black color of the glume, and the pubescence of the back of the second flowering glume showed linkage with the "wild" base. In respect to these characters the data are too involved to be repeated here, but as interpreted by SURFACE they show (1) that the presence of pubescence is a dominant character in the case of the first flowering glume, but a recessive character in the case of the second glume, and (2) that the factor for pubescence of the lower glume is a basic pubescence factor, in the abscence of which the factor for pubescence of the second glume is without effect. The bare facts upon which SURFACE bases these conclusions are as follows. The first hybrid generation has the lower flowering glume pubescent, the upper smooth. In the one parent, *Avena fatua*, both glumes are pubescent; in the other, *A. sativa*,

both are smooth. In no case does segregation in the second or third hybrid generation result in spikelets with the first glume smooth and the second pubescent.

It is not easy to accept a hypothesis which limits the operation of a Mendelian factor to one of two identical and adjacent morphological structures, nor to believe that the character of pubescence is in the case of one of these structures due to a dominant and in the other case to a recessive factor. Furthermore, unless the reviewer has failed to comprehend the data, a much simpler hypothesis will account for the situation. Let us postulate a single dominant factor for the glume pubescence; this factor is linked with the factor for black glumes. A second factor, linked with the factor for "cultivated" base, may be conceived of as a partial inhibitor of the pubescence factor. In accordance with the idea of position effect, it would operate most powerfully upon the second glume, resulting in a first generation hybrid with the pubescence only partially suppressed on the first glume, but completely suppressed on the second. According to this conception, and taking no account of crossing-over, all black-glumed plants in the second hybrid generation would have at least the lower glume pubescent. Both blacks and non-blacks would have undergone segregation with regard to the inhibiting factor, but since blacks alone carry the pubescence factor, a complete loss of the inhibitor could be manifested only by blacks, one-fourth of which would appear, in accordance with expectation, fully pubescent on both glumes. It appears to the reviewer that these considerations apply to the numerical data as well as one could expect.

The cross-overs detected by SURFACE were exceptions to the linkages between the factors for pubescent glumes and black (about 0.7 per cent), and the inhibitor of glume pubescence and the factor for "cultivated" base (about 1.5 per cent).

It seems unfortunate that the author has not used the conventional terminology of the grass inflorescence in his otherwise exceedingly well presented paper. Although he defines his terms, the paper is a long one, and if merely glanced over, the unusual terminology might be perplexing if not misleading. "Head" is used for panicle; "grain" for the caryopsis with its adhering lemma and palea; "pedicel of lower grain" for the portion of the rhachilla between the two fertile florets; "pedicel of upper grain" for the portion of the rhachilla above the second floret; "flowering glumes" for the flowering glume and lemma of the same floret; "dorsal side of grain" for the lemma; "ventral side of grain" for the palea.—H. H. BARTLETT.

Cohesion of water and the rise of sap.—From theoretical considerations RENNER[3] draws the following important conclusions: (1) The vapor pressure

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[3] RENNER, O., Theoretische und Experimentalles zur Kohäsionstheorie der Wasserbewegung. Jahrb. Wiss. Bot. **56**:617–667. 1915. PFEFFER'S Zeitschrift.